**Text S2. WinBUGS models**

**2.1 WinBUGS code for model 0**

# Conditional independence model (result of each diagnostic test on a given patient was independent conditional on true disease status of the patient)

model{

for (i in 1:161){

 status[i]~dbern(prev)

# Likelihood was estimated by five diagnostic tests; including blood culture for *O. tsutsugamushi*, a combination of PCR assays, IFA IgM, Panbio ICT IgM, and presence of an eschar

for (j in 1:5){

 y[i,j]~dbern(p[i,j])

 ypred[i,j]~dbern(p[i,j])

 logit(p[i,j])<-status[i]\*alpha[j]+(1-status[i])\*beta[j]

 }

 }

# Prior

prev~dbeta(0.5,0.5)

alpha[1]~dnorm(0.0,0.1)

 logit(s[1])<-alpha[1]

beta[1]<--1000

for (j in 2:5){

 alpha[j]~dnorm(0.0,0.1)

 beta[j]~dnorm(0.0,0.1)I(,1)

 logit(s[j])<-alpha[j]

 logit(x[j])<--beta[j]

 }

se[1]<-s[1]

se[2]<-s[2]

se[3]<-s[3]

se[4]<-s[4]

se[5]<-s[5]

# Using MCMC to estimate the accuracies of nested 56kDa PCR assay, 47kDa-based real-time PCR assay, *GroEL*-based real-time PCR assay, STIC, combined ICT IgM with presence of eschar, combined *GroEL-*based real-time PCR assay with PanBio ICT IgM, and combined *GroEL-*based real-time PCR assay with presence of eschar

for (i in 1:161){

for (j in 6:12){

 tdiseasetestpos[i,j]<-status[i]\*y[i,j]

 tnondiseasetestpos[i,j]<-(1-status[i])\*y[i,j]

}

}

for (j in 6:12){

se[j]<-sum(tdiseasetestpos[,j])/sum(status[])

x[j]<-1-sum(tnondiseasetestpos[,j])/(161-sum(status[]))

}

# Prediction

for (i in 1:161){

for (k in 1:32){

for (j in 1:5){

 arraymatched[i,k,j]<-equals(ypred[i,j],pattern[k,j])

 }

 nmatched[i,k]<-sum(arraymatched[i,k,])

 matchedpattern[i,k]<-equals(nmatched[i,k],5)

 }

 }

for (k in 1:32){

 freqpred[k]<-sum(matchedpattern[,k])

}

#Bayesian p value

for (i in 1:161){

for (k in 1:32){

for (j in 1:5){

 arraymatchedobs[i,k,j]<-equals(y[i,j],pattern[k,j])

 }

 nmatchedobs[i,k]<-sum(arraymatchedobs[i,k,])

 matchedpatternobs[i,k]<-equals(nmatchedobs[i,k],5)

 }

 }

for (k in 1:32){

 freqobs[k]<-sum(matchedpatternobs[,k])

}

for (k in 1:32){

pvalue[k]<-step(freqpred[k]-freqobs[k])

 }

pvalueSe34<-step(se[4]-se[3])

pvalueSp34<-step(x[4]-x[3])

# PPV and NPV

for (i in 1:161){

for (j in 1:12){

 testpos[i,j]<-y[i,j]

 testneg[i,j]<-1-y[i,j]

 diseasetestpos[i,j]<-status[i]\*y[i,j]

 nondiseasetestneg[i,j]<-(1-status[i])\*(1-y[i,j])

}

}

for (j in 1:12){

 stestpos[j]<-sum(testpos[,j])

 stestneg[j]<-sum(testneg[,j])

 sdiseasetestpos[j]<-sum(diseasetestpos[,j])

 snondiseasetestneg[j]<-sum(nondiseasetestneg[,j])

 ppv[j]<- sdiseasetestpos[j]/stestpos[j]

 npv[j]<- snondiseasetestneg[j]/stestneg[j]

 }

}

**2.2 WinBUGS code for Model 1**

# Conditional dependence model between blood culture for *O. tsutsugamushi* and a combination of PCR assays

model{

for (i in 1:161){

 status[i]~dbern(prev)

for (j in 1:5){

 y[i,j]~dbern(p[i,j])

 ypred[i,j]~dbern(p[i,j])

 }

 }

for (i in 1:161){

for (j in 3:4){

 logit(p[i,j])<-status[i]\*alpha[j]+(1-status[i])\*beta[j]

}

for (j in 1:2){

 logit(p[i,j])<-status[i]\*alpha[j]+(1-status[i])\*beta[j]+status[i]\*re[i]\*Ag

 logit(pstatus[i,j])<-status[i]\*alpha[j]+status[i]\*re[i]\*Ag+(1-status[i])\*(-1000)

}

logit(p[i,5])<-status[i]\*alpha[5]+(1-status[i])\*beta[5]

re[i]~dnorm(0,1)

}

# Prior

prev~dbeta(0.5,0.5)

Ag~dnorm(0.0,0.1)I(0,)

alpha[1]~dnorm(0.0,0.1)

logit(s[1])<-alpha[1]

beta[1]<--1000

for (j in 2:5){

 alpha[j]~dnorm(0.0,0.1)

 beta[j]~dnorm(0.0,0.1)I(,1)

 logit(s[j])<-alpha[j]

 logit(x[j])<--beta[j]

 }

se[3]<-s[3]

se[4]<-s[4]

se[5]<-s[5]

for (j in 1:2){

se[j]<-sum(pstatus[,j])/sum(status[])

}

#Estimating the accuracies of nested 56kDa PCR assay, 47kDa-based real-time PCR assay, *groEL*-based real-time PCR assay, STIC, combined ICT IgM with presence of eschar, combined *GroEL-*based real-time PCR assay with PanBio ICT IgM, and combined *GroEL-*based real-time PCR assay with presence of eschar

for (i in 1:161){

for (j in 6:12){

 tdiseasetestpos[i,j]<-status[i]\*y[i,j]

 tnondiseasetestpos[i,j]<-(1-status[i])\*y[i,j]

}

}

for (j in 6:12){

se[j]<-sum(tdiseasetestpos[,j])/sum(status[])

x[j]<-1-sum(tnondiseasetestpos[,j])/(161-sum(status[]))

}

# Prediction

for (i in 1:161){

for (k in 1:32){

for (j in 1:5){

 arraymatched[i,k,j]<-equals(ypred[i,j],pattern[k,j])

 }

 nmatched[i,k]<-sum(arraymatched[i,k,])

 matchedpattern[i,k]<-equals(nmatched[i,k],5)

 }

 }

for (k in 1:32){

 freqpred[k]<-sum(matchedpattern[,k])

}

#Bayesian p value

for (i in 1:161){

for (k in 1:32){

for (j in 1:5){

 arraymatchedobs[i,k,j]<-equals(y[i,j],pattern[k,j])

 }

 nmatchedobs[i,k]<-sum(arraymatchedobs[i,k,])

 matchedpatternobs[i,k]<-equals(nmatchedobs[i,k],5)

 }

 }

for (k in 1:32){

 freqobs[k]<-sum(matchedpatternobs[,k])

}

for (k in 1:32){

pvalue[k]<-step(freqpred[k]-freqobs[k])

 }

pvalueSe34<-step(se[4]-se[3])

pvalueSp34<-step(x[4]-x[3])

# PPV and NPV

for (i in 1:161){

for (j in 1:12){

 testpos[i,j]<-y[i,j]

 testneg[i,j]<-1-y[i,j]

 diseasetestpos[i,j]<-status[i]\*y[i,j]

 nondiseasetestneg[i,j]<-(1-status[i])\*(1-y[i,j])

}

}

for (j in 1:12){

 stestpos[j]<-sum(testpos[,j])

 stestneg[j]<-sum(testneg[,j])

 sdiseasetestpos[j]<-sum(diseasetestpos[,j])

 snondiseasetestneg[j]<-sum(nondiseasetestneg[,j])

 ppv[j]<- sdiseasetestpos[j]/stestpos[j]

 npv[j]<- snondiseasetestneg[j]/stestneg[j]

 }

}

**2.3 WinBUGS code for Model 2**

# Conditional dependence model between IFA IgM and PanBio ICT IgM

model{

for (i in 1:161){

 status[i]~dbern(prev)

for (j in 1:5){

 y[i,j]~dbern(p[i,j])

 ypred[i,j]~dbern(p[i,j])

 }

 }

for (i in 1:161){

for (j in 1:2){

 logit(p[i,j])<-status[i]\*alpha[j]+(1-status[i])\*beta[j]

}

for (j in 3:4){

 logit(p[i,j])<-status[i]\*alpha[j]+(1-status[i])\*beta[j]+status[i]\*re[i]\*IgM

 logit(pstatus[i,j])<-status[i]\*alpha[j]+status[i]\*re[i]\*IgM+(1-status[i])\*(-1000)

}

logit(p[i,5])<-status[i]\*alpha[5]+(1-status[i])\*beta[5]

re[i]~dnorm(0,1)

}

# Prior

prev~dbeta(0.5,0.5)

IgM~dnorm(0.0,0.1)I(0,)

alpha[1]~dnorm(0.0,0.1)

 logit(s[1])<-alpha[1]

beta[1]<--1000

for (j in 2:5){

 alpha[j]~dnorm(0.0,0.1)

 beta[j]~dnorm(0.0,0.1)I(,1)

 logit(s[j])<-alpha[j]

 logit(x[j])<--beta[j]

 }

se[1]<-s[1]

se[2]<-s[2]

se[5]<-s[5]

for (j in 3:4){

se[j]<-sum(pstatus[,j])/sum(status[])

}

#Estimating the accuracies of nested 56kDa PCR assay, 47kDa-based real-time PCR assay, groEL-based real-time PCR assay, STIC, combined ICT IgM with presence of eschar, combined *GroEL-*based real-time PCR assay with PanBio ICT IgM, and combined *GroEL-*based real-time PCR assay with presence of eschar

for (i in 1:161){

for (j in 6:12){

 tdiseasetestpos[i,j]<-status[i]\*y[i,j]

 tnondiseasetestpos[i,j]<-(1-status[i])\*y[i,j]

}

}

for (j in 6:12){

se[j]<-sum(tdiseasetestpos[,j])/sum(status[])

x[j]<-1-sum(tnondiseasetestpos[,j])/(161-sum(status[]))

}

# Prediction

for (i in 1:161){

for (k in 1:32){

for (j in 1:5){

 arraymatched[i,k,j]<-equals(ypred[i,j],pattern[k,j])

 }

 nmatched[i,k]<-sum(arraymatched[i,k,])

 matchedpattern[i,k]<-equals(nmatched[i,k],5)

 }

 }

for (k in 1:32){

 freqpred[k]<-sum(matchedpattern[,k])

}

#Bayesian p value

for (i in 1:161){

for (k in 1:32){

for (j in 1:5){

 arraymatchedobs[i,k,j]<-equals(y[i,j],pattern[k,j])

 }

 nmatchedobs[i,k]<-sum(arraymatchedobs[i,k,])

 matchedpatternobs[i,k]<-equals(nmatchedobs[i,k],5)

 }

 }

for (k in 1:32){

 freqobs[k]<-sum(matchedpatternobs[,k])

}

for (k in 1:32){

pvalue[k]<-step(freqpred[k]-freqobs[k])

 }

pvalueSe34<-step(se[4]-se[3])

pvalueSp34<-step(x[4]-x[3])

# PPV and NPV

for (i in 1:161){

for (j in 1:12){

 testpos[i,j]<-y[i,j]

 testneg[i,j]<-1-y[i,j]

 diseasetestpos[i,j]<-status[i]\*y[i,j]

 nondiseasetestneg[i,j]<-(1-status[i])\*(1-y[i,j])

}

}

for (j in 1:12){

 stestpos[j]<-sum(testpos[,j])

 stestneg[j]<-sum(testneg[,j])

 sdiseasetestpos[j]<-sum(diseasetestpos[,j])

 snondiseasetestneg[j]<-sum(nondiseasetestneg[,j])

 ppv[j]<- sdiseasetestpos[j]/stestpos[j]

 npv[j]<- snondiseasetestneg[j]/stestneg[j]

 }

}

**2.4 WinBUGS code for sceptical prior**

# Conditional dependence model between IFA IgM and PanBio ICT IgM

model{

for (i in 1:161){

 status[i]~dbern(prev)

for (j in 1:5){

 y[i,j]~dbern(p[i,j])

 ypred[i,j]~dbern(p[i,j])

 }

 }

for (i in 1:161){

for (j in 1:2){

 logit(p[i,j])<-status[i]\*alpha[j]+(1-status[i])\*beta[j]

}

for (j in 3:4){

 logit(p[i,j])<-status[i]\*alpha[j]+(1-status[i])\*beta[j]+status[i]\*re[i]\*IgM

 logit(pstatus[i,j])<-status[i]\*alpha[j]+status[i]\*re[i]\*IgM+(1-status[i])\*(-1000)

}

logit(p[i,5])<-status[i]\*alpha[5]+(1-status[i])\*beta[5]

re[i]~dnorm(0,1)

}

# Prior

prev~dbeta(0.5,0.5)

IgM~dnorm(0.0,0.1)I(0,)

alpha[1]~dnorm(0.0,1)

 logit(s[1])<-alpha[1]

beta[1]<--1000

for (j in 2:5){

 alpha[j]~dnorm(0.0,1)

 beta[j]~dnorm(0.0,1)I(,1)

 logit(s[j])<-alpha[j]

 logit(x[j])<--beta[j]

 }

se[1]<-s[1]

se[2]<-s[2]

se[5]<-s[5]

for (j in 3:4){

se[j]<-sum(pstatus[,j])/sum(status[])

}

#Estimating the accuracies of nested 56kDa PCR assay, 47kDa-based real-time PCR assay, groEL-based real-time PCR assay, STIC, combined ICT IgM with presence of eschar, combined *GroEL-*based real-time PCR assay with PanBio ICT IgM, and combined *GroEL-*based real-time PCR assay with presence of eschar

for (i in 1:161){

for (j in 6:12){

 tdiseasetestpos[i,j]<-status[i]\*y[i,j]

 tnondiseasetestpos[i,j]<-(1-status[i])\*y[i,j]

}

}

for (j in 6:12){

se[j]<-sum(tdiseasetestpos[,j])/sum(status[])

x[j]<-1-sum(tnondiseasetestpos[,j])/(161-sum(status[]))

}

# Prediction

for (i in 1:161){

for (k in 1:32){

for (j in 1:5){

 arraymatched[i,k,j]<-equals(ypred[i,j],pattern[k,j])

 }

 nmatched[i,k]<-sum(arraymatched[i,k,])

 matchedpattern[i,k]<-equals(nmatched[i,k],5)

 }

 }

for (k in 1:32){

 freqpred[k]<-sum(matchedpattern[,k])

}

#Bayesian p value

for (i in 1:161){

for (k in 1:32){

for (j in 1:5){

 arraymatchedobs[i,k,j]<-equals(y[i,j],pattern[k,j])

 }

 nmatchedobs[i,k]<-sum(arraymatchedobs[i,k,])

 matchedpatternobs[i,k]<-equals(nmatchedobs[i,k],5)

 }

 }

for (k in 1:32){

 freqobs[k]<-sum(matchedpatternobs[,k])

}

for (k in 1:32){

pvalue[k]<-step(freqpred[k]-freqobs[k])

 }

pvalueSe34<-step(se[4]-se[3])

pvalueSp34<-step(x[4]-x[3])

# PPV and NPV

for (i in 1:161){

for (j in 1:12){

 testpos[i,j]<-y[i,j]

 testneg[i,j]<-1-y[i,j]

 diseasetestpos[i,j]<-status[i]\*y[i,j]

 nondiseasetestneg[i,j]<-(1-status[i])\*(1-y[i,j])

}

}

for (j in 1:12){

 stestpos[j]<-sum(testpos[,j])

 stestneg[j]<-sum(testneg[,j])

 sdiseasetestpos[j]<-sum(diseasetestpos[,j])

 snondiseasetestneg[j]<-sum(nondiseasetestneg[,j])

ppv[j]<- sdiseasetestpos[j]/stestpos[j]

 npv[j]<- snondiseasetestneg[j]/stestneg[j]

 }

}

**2.5 WinBUGS code for enthusiastic prior**

# Conditional dependence model between IFA IgM and PanBio ICT IgM

model{

for (i in 1:161){

 status[i]~dbern(prev)

for (j in 1:5){

 y[i,j]~dbern(p[i,j])

 ypred[i,j]~dbern(p[i,j])

 }

 }

for (i in 1:161){

for (j in 1:2){

 logit(p[i,j])<-status[i]\*alpha[j]+(1-status[i])\*beta[j]

}

for (j in 3:4){

 logit(p[i,j])<-status[i]\*alpha[j]+(1-status[i])\*beta[j]+status[i]\*re[i]\*IgM

 logit(pstatus[i,j])<-status[i]\*alpha[j]+status[i]\*re[i]\*IgM+(1-status[i])\*(-1000)

}

logit(p[i,5])<-status[i]\*alpha[5]+(1-status[i])\*beta[5]

re[i]~dnorm(0,1)

}

# Prior

prev~dbeta(0.5,0.5)

IgM~dnorm(0.0,0.1)I(0,)

alpha[1]~dnorm(3,0.4)

 logit(s[1])<-alpha[1]

beta[1]<--1000

for (j in 2:5){

 alpha[j]~dnorm(3,0.4)

 beta[j]~dnorm(-3,0.4)I(,1)

 logit(s[j])<-alpha[j]

 logit(x[j])<--beta[j]

 }

se[1]<-s[1]

se[2]<-s[2]

se[5]<-s[5]

for (j in 3:4){

se[j]<-sum(pstatus[,j])/sum(status[])

}

#Estimating the accuracies of nested 56kDa PCR assay, 47kDa-based real-time PCR assay, groEL-based real-time PCR assay, STIC, combined ICT IgM with presence of eschar, combined *GroEL-*based real-time PCR assay with PanBio ICT IgM, and combined *GroEL-*based real-time PCR assay with presence of eschar

for (i in 1:161){

for (j in 6:12){

 tdiseasetestpos[i,j]<-status[i]\*y[i,j]

 tnondiseasetestpos[i,j]<-(1-status[i])\*y[i,j]

}

}

for (j in 6:12){

se[j]<-sum(tdiseasetestpos[,j])/sum(status[])

x[j]<-1-sum(tnondiseasetestpos[,j])/(161-sum(status[]))

}

# Prediction

for (i in 1:161){

for (k in 1:32){

for (j in 1:5){

 arraymatched[i,k,j]<-equals(ypred[i,j],pattern[k,j])

 }

 nmatched[i,k]<-sum(arraymatched[i,k,])

 matchedpattern[i,k]<-equals(nmatched[i,k],5)

 }

 }

for (k in 1:32){

 freqpred[k]<-sum(matchedpattern[,k])

}

#Bayesian p value

for (i in 1:161){

for (k in 1:32){

for (j in 1:5){

 arraymatchedobs[i,k,j]<-equals(y[i,j],pattern[k,j])

 }

 nmatchedobs[i,k]<-sum(arraymatchedobs[i,k,])

 matchedpatternobs[i,k]<-equals(nmatchedobs[i,k],5)

 }

 }

for (k in 1:32){

 freqobs[k]<-sum(matchedpatternobs[,k])

}

for (k in 1:32){

pvalue[k]<-step(freqpred[k]-freqobs[k])

 }

pvalueSe34<-step(se[4]-se[3])

pvalueSp34<-step(x[4]-x[3])

# PPV and NPV

for (i in 1:161){

for (j in 1:12){

 testpos[i,j]<-y[i,j]

 testneg[i,j]<-1-y[i,j]

 diseasetestpos[i,j]<-status[i]\*y[i,j]

 nondiseasetestneg[i,j]<-(1-status[i])\*(1-y[i,j])

}

}

for (j in 1:12){

 stestpos[j]<-sum(testpos[,j])

 stestneg[j]<-sum(testneg[,j])

 sdiseasetestpos[j]<-sum(diseasetestpos[,j])

 snondiseasetestneg[j]<-sum(nondiseasetestneg[,j])

 ppv[j]<- sdiseasetestpos[j]/stestpos[j]

 npv[j]<- snondiseasetestneg[j]/stestneg[j]

 }

}